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Comparison of Conventional and Islamic Banking

Komparace konvenčního a islámského bankovnictví

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Bibliography
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Annexes

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The declaration

Herewith I declare that I elaborated the entire thesis, including all annexes, independently.

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Contents:

1 Introduction

Banks play an important and central role in the financial system and the economy. As a key component of the financial system, they provide specialized financial services, which reduce the cost of obtaining information about both savings and borrowing opportunities. These financial services help to make the overall economy more efficient. With the emergence of the modern banking system, financial and economic relations has developed in a fast manner. The financial model that contributed to this development was the interest-based banking system, which raised serious controversies throughout the history. On the other hand, in the Muslim world, the interest-based banking model has been discouraged because of the strong ban introduced by Islam. In 1970s, an alternative model has been offered and it has called Islamic finance. It is possible to argue that the modern Islamic finance model merged the traditional commercial methods of Islam and the conventional finance system's institutions and products.

The aim of this thesis is to give a comprehensive comparison between conventional and Islamic finance. Moreover, it will provide comparison between different conventional and Islamic mortgages in UAE; in order to find the optimal option of mortgage for a defined physical person, based on MCDA methodology. The reason behind choosing UAE, because of the availability of a dual banking system there, moreover, the UAE became an important financial center during the last decade with well-noticed development in the banking industry.

This thesis consists of five chapters. The first chapter is about a brief overall introduction. The second chapter is description of the characteristics of conventional and Islamic banking systems. The third chapter is brief about the starting and development of conventional and Islamic banking systems. The fourth chapter is comparison between mortgages provided by conventional and Islamic banks in UAE, based on MCDA analysis. And the final chapter contains the conclusions of this thesis.

In chapter 2, there will be detailed description of the main principles of conventional banking system, their process and features, categories, types and services

of banks in conventional banking system. In addition, detailed description of the basis of Islamic law, and the main principles of Islamic banking system, their process and features, and description of contracts in Islamic finance, followed by comparison of differences and similarities between these two banking systems.

Chapter 3 includes an overview of the historical start of conventional banking and the commercial relations in the communities that existed. Moreover, it is followed by description of the commercial relations in the communities in the Arabian Peninsula, Middle East and Africa before and after Islam, while it was important to outline the main idea and the historical stages to establish the Islamic banking, and description of their development in the history.

In chapter 4, we will apply multi-criteria decision analysis method (MCDA) and its application AHP, in order to compare between different mortgages in United Arab Emirates from the prospective of the client. This chapter will consist of description of MCDA, and description of the calculations and interpretation and the result of this thesis.

A conclusion of the result of this study will be stated in the last chapter along with comprehensive comments on the topic.

2 Characteristics of Conventional Banking and Islamic Banking

This chapter outlines an overview of conventional banking and Islamic banking characteristics. The first part describes the main principles of conventional banking system, their process and features, categories and types of banks in conventional banking, and what kind of services are provided by the conventional banks. And then the second part, the basis of Islamic law, and the main principles of Islamic banking system, their process and features, and description of contracts in Islamic finance. Finally, in the third part, I briefly highlight in the conclusion the main differences and similarities between these banking systems.

2.1 Introduction

The emergence of the banking systems has been linked to the transformation of the economies through the stages of economic and social development, moreover, to the prevailing policies, traditions, and ideas that affect this development. Therefore, the banking system varies in different countries in response to the changing conditions and economic changes that been experienced by these countries.

With the beginning of the second half of the 20th century, the banking system has been undergoing successive changes. The emergence of the Islamic banking system in 1970s led many countries and financial institutions to change their financial structures to adopt and introduce dual financial system, where both Islamic and conventional finance are operated. Dual banking system exist particularly in Muslim countries like Saudi Arabia, UAE, Qatar, Bahrain, and Malaysia … etc. In addition, in the Middle East region *e.g.* Syria, Lebanon, Jordan … etc. Many other countries have developed special regulations to facilitate the working of Islamic banking as UK, France, China, Singapore and we can find many important global conventional banks like Standard Chartered Bank, Deutsche Bank, Citibank, HSBC, etc, are offering Islamic banking services and products to their clients who are interested in profit and loss sharing financial instruments.

Islamic and conventional banks compete with each other in absorbing clients and investors; they are not supplementary to each other. The presence of this competition was an important reason to improve the quality and efficiency of financial intermediation in countries that adopted the dual banking system.

2.2 Characteristics of Conventional Banking System

The emergence of conventional banking system was in Italy. The profession of banking grew out of the trade and the commercial revolution of the high middle ages (1000 – 1350). However, banking spread and developed throughout Europe and became complex due to the needs of different financial services and especially in credit transactions to support the trade, which has been one of the most important activities that helped the development of banks' business.

The fundamental of this system is based on the concept of interest, which is considered to be the price of credit, reflecting the opportunity cost of money. Money in conventional banking system is used as a commodity, which is bought and sold, and on such two-way transactions, there is an interest being charged.

2.2.1 Principles of Conventional Banking System

The objective of conventional banks is to achieve profitability and a suitable return for its shareholders. In order to achieve this objective, the banks invest the money obtained from various sources and reduce its expenses as possible. The total revenues of conventional banks consist mainly of loans and investment operations in addition to the capital gains that has been achieved by the bank. However, it is very important to keep part of the money to guarantee the liquidity on high level in order to meet the regular or sudden withdrawals of the Bank's clients.

In conventional banks, deposits from savers and investors are accepted on the loan concept, for all types of deposit accounts including term deposit, savings and currents accounts. Interest based returns are provided for the savings accounts and term deposits, the banks are liable to pay fixed rates of interest to depositors at the completion

of term whether they earn profit or suffer loss. The depositors have nothing to do with the loss of bank. Whereas current accounts may offer free banking facilities. Moreover, the banks lend these collected funds to borrowers, and the banks charge an interest on these loans, based on its competitive advantage at gathering information and underwriting risk. In such way, the banks make profit from the spread between the rate that they pay to depositors and the rate they receive from borrowers. This ability of banks to pool deposits from many sources that can be lent to many different borrowers creates the flow of funds characteristic of the banking system. By managing this flow of funds, banks generate value for the society.

Figure 2.1: Transactions in Banking System

In explaining the conventional banking function process, we can find two well-known approaches:

- The production approach: banking activities are described as the production of services to depositors and borrowers.
- The intermediation approach: identify the bank as intermediaries of financial services and assumes that banks collect funds (deposits and purchased funds with the assistance of labor and capital) and transform these into loans and other assets. The deposits are treated as inputs along with capital and labor and the volumes of earning assets are defined as measures of output.

2.2.2 Categories of Conventional Banks

The forms of banks differ in different societies according to their specialization and the role they play in the society. The multiplicity of forms of banks is a matter of specialization and the desire to find independent financing structures suited to the needs

of customers and society. Over the last three decades, banking business has experienced substantial changes. These changes lead to transfer the banking business operations from relatively narrow activities to financial firms that provide full services. Introducing the so-called universal banking model in Europe in 1992, gave a broad definition of the banking business. Under this model, banking business could undertake a wide range of financial services activity including securities operations, insurance, pensions, leasing and so on. In addition, the deregulation of various factors have had an impact on banking business globally such the disappearing of capital restrictions, lowering the balance sheet restrictions and the decline of the role of state banks. These new trends accompanied with huge and revolutionary technological development, which allowed improving the communication and information transferring with lowering the costs and providing new services to the banks clients in different geographical scopes.

Due to the mentioned factors, and in order to meet a broad range of customer financial service demands, banks have had to diversify their activities and implement new forms of financial institutions. We can distinguish three main categories of banking in conventional banking system and each of them divided to sub categories:

Retail or Personal banking: It offers a variety of banking services to customers. It provides basic services from deposits, loans, savings, insurance and pensions in addition to various payments services. Different types of banks offer retail-banking services, these include:

- Commercial banks
- It is the major financial intermediary in all economies. Their main role is concentrated in providing credits, acceptance of deposits and controlling the payments mechanism. Commercial banks are second in terms of the banking system hierarchy, after the Central Bank. It controls almost all of the assets of the banking sector. Commercial banks are typically joint stock companies and may be either publicly listed on the stock exchange or privately owned. Commercial banks deal with both retail and corporate customers, and they engage in insurance, investment banking and other financial services.

- Savings banks
- They differ from commercial banks in their ownership form. Savings banks have traditionally had mutual ownership, being owned by their 'members' or 'shareholders' who are the depositors or borrowers. They offer a wider range of small firm corporate loans, credit cards and other facilities. Savings banks pursue objectives relating to the social and economic development of the region in which they operate.
- Finance houses
- They provide finance to individuals and companies by making consumer, commercial and other types of loans. Typically, they raise funds by issuing money markets and capital market instruments, and not by taking deposits. All major retail firms and motor companies have their own finance house subsidiaries.
- Private banking
- They provide a range of high quality financial services to wealthy clients, mainly individuals and their families. Their services combine retail banking products, and wide range of investment related services.
- Co-operative banks
- Building societies
- Credit unions

Corporate banking: provide their services to companies and mainly large firms. Their services depends on the size of the firms. Moreover, banking services provided to small firms mainly about:

- payment services,
- debt finance,
- equity finance,
- special financing.

In addition, banking services provided for mid-market and large (multinational) corporate clients mainly about:

- cash management and transaction services,

- credit and other debt financing facilities,
- commitments and guarantees,
- foreign exchange and interest rate-related transactions,
- securities underwriting and fund management services.

Investment banking: Investment banks relates to large-scale financing activities. Typically do not deal with retail customers, mainly they deal with companies and other large institutions. Their main role is to help companies and governments raise funds in the capital market either through the issue of stock or debt (bonds).

2.2.3 Conventional Banks Services

Conventional banks provide wide variety of services to their clients. They provide loans to government, business firms, public sector organizations and individuals. In addition, to services such as:

- Payment services, it includes cheques, credit transfers, standing orders, direct debits and plastic cards which includes credit cards, debit cards, cheque guarantee cards, travel and entertainment cards, shop cards and 'smart' or 'chip' cards.
- Deposit services, it includes current or checking accounts, time or savings deposits that involve depositing funds for a set period of time for a pre-determined or variable rate of interest.
- Investment products, pensions and insurance services,
- E-banking.

Banks offer lending facilities to their clients to fulfil their cash requirement on the basis of loan contracts where the relationship between the Bank and client is that of lender and borrower respectively. Characteristic of banks loans:

- no risk of underlying assets,
- income through Interest,
- late payment charges on delayed payments and shall constitute bank's income.

Moreover, conventional banks offers trade finance related operations under the concepts of services, guarantee and lending.

Conventional banks trade transactions characteristics:

- commission based Income,
- income through guaranteeing payments,
- income through Interest on loan payments,
- additional interest income on delayed payments.

2.3 Characteristics of Islamic Banking System

The Islamic banking system was created to meet the needs of people and communities who follow the Islamic religion, which is based on several principles derived from divine sources according to the Islamic belief. The prohibition of interest and investment in businesses which are considered contrary to Islamic principles have been applied historically in varying degrees in Muslim communities to prevent un-Islamic practices. Therefore, it was important to create a system that can provide full financial services that comply with the principles of Islam. The second half of the 20th century witnessed the official emerge of the Islamic banking system. During the recent decades, Islamic banking has evolved and grown rapidly in many countries. The following table illustrates the distribution of Islamic banks in the world:

Tab. 2.1: Islamic banks by regions (2002)

Region	Number of institutions	Percentage
South and South East Asia	18	18.56
GCC	42	43.30
Other Middle Eastern countries	14	14.43
Africa	9	9.28
Rest of the world	14	14.43
Total	97	100

***Note**: GCC = Gulf Co-operation Council countries (Saudi Arabia, Bahrain, Kuwait, Oman, Qatar, and the United Arab Emirates)*

Source: M. Iqbal and P. Molyneux (2005), p. 57

2.3.1 Islamic Law

It is an important to know the basic ideas and beliefs in the Islam religion, in order to understand the concept of the Islamic Banking. The Islamic Banking rules and codes are based on the Islamic Sharia law. The principle sources of Sharia law are the Quran, Prophet Muhammad's sayings, called "hadeeth," and his deeds or tradition, called "Sunnah".

In the Islamic religion, it is believed that the God owns every asset in this world, as it is stated in the Quran. In other words, the people who are living on this earth were chosen by the God to be the trustees of these assets on behalf of the real owner – God-. People are responsible before God and public for protection, preserving, and investing these assets to be used in equitable way to achieve economic prosperity and peaceful community.

There is an important fundamental red line in the teachings of Islam-the line that separates what is divinely permissible, called halal, and what is divinely not permissible, called haram (Abdul-Rahman, 2014). According to this concept, all activities, professions, contracts and transactions that are prohibited by Quran or Sunnah considered as haram. Moreover, all other activities, professions, contracts and transactions are considered as halal. Therefore, Islamic finance have unique characteristics because of their specific nature and setting their principles and rules that are based on elimination of the payment and receipt of interest in all forms. Prohibition of interest is not only limited to Islam but it is also clearly forbidden in Judaism and Christianity. This concept differentiates Islamic finance from conventional finance. Accordance to the principle of halal and haram, we can find three fundamental prohibitions in Islamic finance, Al Gharar (uncertainty), Al Riba (interest) and Al Maysir (gambling, speculation).

- **Al Gharar**: is associated with high uncertainty that may cause any injustice or deceit against any of the parties in the contract. Gambling shows Al Gharar in its extreme form, as well short selling, speculation and derivatives.

- **Al Riba:** is determined as haram and considered as one of the worst sins as reported in Quran and Hadeeth. The main concept is that money should not be priced, because Islam does not recognize money as a commodity having an intrinsic value, and therefore returns cannot be guaranteed just out of advancing loans. Sharia requires finance to be accompanied by human action, risk sharing and management to earn returns. The aims to achieve justice between the financier and the borrower: the financier should not receive any positive return without taking any action or taking any risk, while the borrower, despite his management and hard work, is not assured of the return.

2.3.2 Principles of Islamic Banking System

The sharing of profit and loss, and thus risk sharing is a fundamental principle that Islamic banking system relies on. Due to this, It is been considered that participants in banking transactions are business partners who jointly accept the risks and profits. Islamic banking products are equity based financing which based on different methods of profit and loss sharing. Therefore, we can distinguish between two kinds of deposits: Investment deposits and transactions deposits. In investment deposits, depositors are no longer guaranteed the face value of their deposits, they become as shareholders, and they gain or lose depending on the profits and/or losses of the bank. The bank and the depositor should agree on the profit and loss ratio upon in advance, and it cannot be changed during the life of the contract. On the liability side of the balance sheet, the depositors considered as shareholders; but on the asset side, the bank has shares from joint ventures it helps finance. In the transaction deposits, the face value of deposits is guaranteed. There are no returns on this type of deposits, and a service charge may be applied.

Islamic finance covers all transactions for Muslims (and it is used by Non-Muslim) to facilitate their ability to invest in agreement with Islamic law. In practice, it involves using traditional investment techniques, procedures and structures that only comply with Islamic law (Sharia), thus it makes it work in similar way to the modern conventional finance. Therefore, it was necessary for Islamic finance to have a religious

board (Sharia committee), and their main job is to examine the proposed transactions and, their task in the Islamic banks is to reviews all the bank activities to be sure that it complies with Sharia law. Islam prohibits investing in businesses that considered unlawful (haram) activities. As example of these activities, those related to pornography, alcohol and drugs.

2.3.1 Categories of Islamic Banks

Most of Islamic banks are joint stock companies. The ownership can belong to some financial holding company, or established by private or semi-government initiative. Moreover, in some cases, the government would subscribe to the capital of the Islamic banks.

Based on the nature of the services they provide, we can distinguish three main categories of banking in Islamic banking system:

- Islamic commercial banks

  Most of Islamic banks are under this category. This type of banks perform their activities in a similar way to the commercial banks, but in compatible way with Islamic sharia. They offer wide variety of alternative modes of finance.
- Development banks

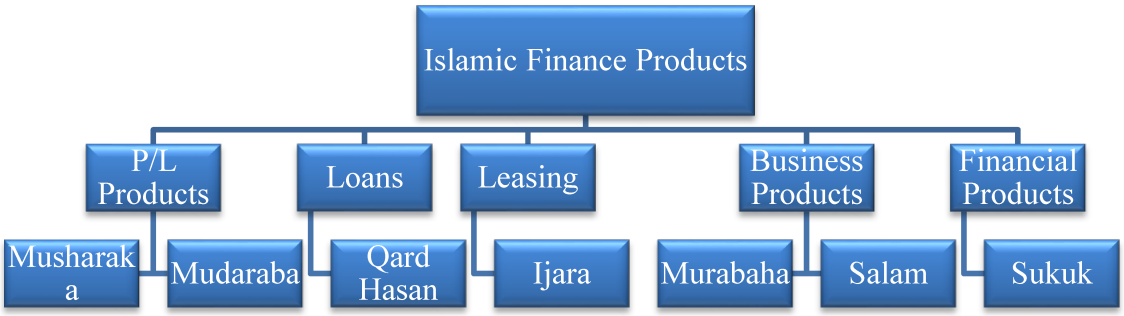
  Their main role is to boost the process of social and economic development in the region where they operate. They finance different development projects.
- Specialized Islamic banks

  These type of banks may be created to serve and support special sectors and class of clients. They provide wide range of services. As example of these banks: Agriculture banks, social banks, and industrial banks.

2.3.2 Products in Islamic Finance

Islamic banks use the same banking operations tools and procedures as conventional banks. These activities include foreign exchange transactions, domestic and international transfers, and letters of credit. In order to enable the clients of Islamic banks to practice their financial activities, banks developed products and services that do not charge or pay interest and based on profit-loss sharing concept. Depositors earn a return (instead of interest) and borrowers repay loans based on the profits generated from the project on which the loan is lent. The following offered products and contracts by Islamic banks will illustrate the principles that have previously mentioned in this chapter.

Figure2.1: Islamic Finance Products



Musharaka (partnership): it is an agreement between the borrower and the bank, where they agree to establish joint commercial enterprise for effecting certain operations within an agreed period. Both parties contribute to the capital, labor and management as well. The profit is shared among the partners in previously agreed proportions while the loss will have to be shared in strict proportion of capital contributions. This kind of contract illustrate the profit-loss sharing concept.

Murabaha: Cost – plus financing = Murabaha. It is being used by the majority of the Islamic banks and financial organizations as an Islamic method of financing, and many of their financing procedures are based on this concept. To define Murabaha; it is a contract for purchase and resale, through which the customer knows the profit margin. After the sale has happened, the seller is not allowed to change the price throughout the contract. The profit margin may be in a form of more sums or may be as percentage.

Murabaha contracts are widely used in providing of personal finance and car financing contracts by Islamic banks. For example, the Bank, upon instructions from the customer, purchases the car, and re-sells it directly to the customer on a deferred basis, adding an agreed profit margin. The ownership is also should be transferred into customer's name. Then, the customer pays the sale price for the car over installments. The Murabaha agreement records the trade between the bank and the customer. In personal finance, if the client indicates interest in buying the goods, the bank purchases the goods in favor of the customer from the seller and sells them to the customer by way of adding an agreed profit margin.

Moreover, in Islamic finance, we can find other different types of products and contracts that are allowed to be used in order to help clients meet their needs in accordance with the provisions of Islamic law.

Qard/ Qard al-Hasan: is a loan that is given to the customers without charge of any profit-sharing margin, but normally repaid by instalments and backed by guarantee.

Ijara: Ijara is a form of leasing. It is a contract whereby the Bank buys the property (movable or immovable) under its name, and leases it to the customer for the purpose of use, with an option to purchase the item at the end or during the lease period at a pre-agreed price. Ijara contracts are the most suitable for home financing, whereby the bank (lessor) purchases the property and the client (lessee) uses the property and pays rents for an agreed period. The Islamic bank retains ownership of the item throughout the arrangement and assumes possession of the item at the end of the lease period. This applies to car financing as well.

Al Mudaraba: The Mudaraba contract is a profit-sharing arrangement in which the capital provider bears the risk and the manager of funds (Mudarib) contributes the technical expertise and management skills to employ funds in activities that comply with Islamic Sharia and obtain a rate of the return. Mudaraba contracts are mainly used in savings accounts and fixed deposits (term investments) for Islamic banks. The customer provides the funds with prior agreement with the bank (Mudarib or Fund

Manager) on the profit sharing ratio. The Mudarib invests money and shares the return with the customer at the end of the period.

Al ujra: It is a compensation or service charge, or an agency contract in which one person appoints someone else to perform a specific task on his/her behalf, usually for a certain fee. It is widely used in Islamic credit cards, offering clients the facility of using cards issued to them to meet their personal needs, and the bank pays the sellers and merchants on behalf of the client. For this monthly activity, the Bank applies a monthly fee to client.

Sukuk: It is Islamic securities that can be sold and purchased on the financial market. The condition is that the underlying asset is the tangible property of a thing, the right of use for the enterprise itself. They are often used in conjunction with other techniques of Islamic finance, and are issued with international accounting standards by AAOIFI. Their importance on the world financial markets is growing rapidly.

According to the nature of Islamic banks products, it is possible to divide it based on their presence in the balance sheet as per the following table:

Tab. 2.2: Islamic banks products

Specific products		General Products
Asset side products	Liability side products	
Murabaha	Current accounts	Sukuk arrangement
Mudaraba	Basic banking account	Financial advisory
Musharaka	Savings accounts	Private placement
Ijarah	Term deposits of various maturities	Syndication
Diminishing musharaka	Certificates of investment	Trusteeship
Salam		Underwriting
Istisna		Structured finance
Wakala		Project financing
Islamic export		
Corporate/ commercial		

Agriculture		
Consumer		
Commodity financing		
SME sector		
Treasury & financial Institutions		

2.4 Conclusion

Conventional banking and the Islamic banking has some basic difference in theory and practice. Although the basic function of the two institutions is to collect savings and transform them into junk amount and then lend borrowers, yet the mode and the objective of the collection of surplus funds from the savers and lending it to the borrowers is different. However, the following table will summarize and illustrate the points that differentiate these two banking systems:

Table. 2.4.1: differences between Conventional and Islamic Banking

	Conventional banking	Islamic banking
Principles	The functions and operating modes are based on fully manmade principles	The functions and operating modes are based on Islamic sharia law
Objectives	The main objective is to maximize the shareholders wealth	The main objective is to stimulate business activities through profit-and-loss sharing
Concept of money	Money is considered as a commodity which is bought and sold and on such two-way transactions they charge interest	Money is considered as a medium of exchange to facilitate trade transactions, and all transactions have to be based on a real economic transaction, which includes a tangible asset principle

Deposits	The lender/investor is guaranteed of predetermined of interest.	It's based on risk sharing between the investor (provider of capital) and the entrepreneur (the user of funds)
Finance	Banks provide loans for different kind of projects based on interest rates	Islamic banks finance projects only comply with Islamic sharia principles based on profit-loss sharing
Investments	Investment in government Treasury bills, bonds and term finance certificates for security and smooth return	Invest in non-interest bearing financial instruments like equity market, Islamic money market, Islamic Sukuk and Islamic mutual funds. They are prohibited to invest in government bonds and treasury bills.
Bank- customer relationship	Bank- customer relationship: loan lender and borrower	Bank- customer relationship: seller, buyer or partner

Practically, Islamic scholars have developed similar products to those of conventional banking, by replacing interest rate payments and discounting with fees and contingent payment structures. It is seen that purposes and functions of Islamic banking resemble to those of conventional banks.

3 DEVELOPMENT OF CONVENTIONAL AND ISLAMIC BANKING SYSTEMS

This chapter outlines an overview of the beginning and development of conventional banking and Islamic banking systems. The first part describes the historical start of banking in the old times, commercial relations in the communities were existed, and the gradual transformation into the modern banking through applying and introducing different functions. The second part, outlines the commercial relations in the communities in the Arabian Peninsula, Middle East and Africa before and after Islam, the main idea and the attempts to establish the Islamic banking, and description of their development in the history.

3.1 Starting and Development of Conventional Banking

Many researchers have credited the Greeks for the development of banking in the ancient times. Moreover, the banking system expanded and spread after the Roman adaption of this system, especially with the expansion of the areas they control. In the late middle Ages, the development of banking system continued with the prosperity of the trade and industry in Italy. Various economic and political conditions influenced the banking development, especially between the 19th and 20th century and the globalization era, which introduced the new modern banking and the universal banking system.

3.1.1 The Emergence of Banking

Since the beginning of the human societies, the need arose for the exchange of goods and services among members of these societies. Barter system was the primary means of exchange, but the barter system was not appropriate even in the primitive economic system. After that, there was gradual transformation from goods and services barter system to the silver and gold bullions barter system. This kind of barter had a negative side as a means of exchange, as it was not available in all places and times; therefore, the appropriate solution was coinage. Even though, the coins had a negative side, is the possibility of theft during storage or transfer. In order to mitigate the risk of

theft, there was a need to find a way to preserve and protect these coins by finding special stores where the owners can deposit their coins. This coinage transformation was the beginning of the intervention of governments in monetary matters.

The spread of dealing with a mixture of different currencies in different weight, fineness and origin in trade and market centers in Europe led to the emergence of the cambists. Cambists played roles of receiving the money of merchants as deposits, with the willingness to return these deposits to depositors whenever they demand it. Some researchers have credited the development of banking to goldsmiths, where they have kept the gold, for giving delivery receipt to the depositor in order to restore the deposit in person. The role of goldsmiths was similar to the role of modern banks, through the preservation and protection of deposits. Therefore, the function of modern banks in the acceptance of deposits have transferred to them from the goldsmiths and cambists who have exercised this job at the beginning of their communities.

3.1.2 Development of Conventional banking

The monetary function appeared at a later stage, when the depositor became able to transfer the deposited funds to another particular person, by written request from the depositor requesting the delivery of the deposited funds to another beneficiary. If the new beneficiary does not wish to withdraw the transferred deposited funds, by signing of a certificate of deposit, it became sufficient to transfer the ownership of the deposited funds from the original depositor to the new beneficiary, without actual delivery of the deposited funds. This was the beginning of the use of checks to transfer ownership of the money. At a later stage, the goldsmiths started to issue certificates of deposits at the nominal value of the deposited amount rather than the receipt. This paper or certificate could be exchanged on demand with its nominal value of gold. Because the phenomenon of manipulating by the cambists was exposed; therefore, there was a need for the establishment of banks. In the region of Lombardy, while Casa di San Giorgio in Genoa is considered the first bank and was established in 1407, the Bank of Venice was established in 1587, the Bank of Amsterdam in 1609 and the Bank of Hamburg in 1619. The aim was to concentrate the deposit operations in banks under the

supervision of the governments. In order to protect the depositors from the cambists manipulation.

The lending function appeared when the experienced cambists and goldsmiths realized that they do not have to keep all the valuable deposits, as long as the depositors are confident that they can exchange their certificates of deposit with the corresponding precious coins upon request. Moreover, these depositors became more compliant with making payments by the transfer of receipts and certificates of deposit, with gold and silver coins held in cambists and goldsmiths vaults. Cambists and goldsmiths began to issue receipts and certificates of deposits more than the value of the deposited funds that they preserve in their vaults. After that, the value of existing reserves that correspond to the actual withdrawals of gold and silver coins became as part of the total value of the receipts and certificates issued by them, which make it possible to use what is considered as an excess to the reserve portion, for the lending operations. The modern bank has become able to lend from the customers deposits to those who need to borrow after providing adequate guarantees, while the bank charge an interest for providing this service. However, the banks no longer provide only loans from their own deposits, but rather provide loans from deposits that do not exist. As a result, these deposits are created by the bank. This is one of the most important functions of commercial banks, money creation (deposits creation).

Money creation (deposits creation) the process of generating money (creating deposits) have started when the bankers got sure that it is rare for all depositors to request their deposits at the same time. This gave birth to the idea of partial reserve. By practice and experience, the banks got the people trust in their ability to meet the demand of the depositors whenever they request deposit withdrawals, because these banks retain appropriate reserves. The money creation (deposits creation) happen when the bank lends part of its available financial resources. After that, the borrower will re-deposit the loan in a bank, these deposits are called derivatives, to distinguish them from the original deposits, which represents clients deposited money or checks, which been obtained through the non-borrowing units of the banking system. In addition, the second bank with whom the loan is deposited (the derivative deposit) and after deducting the necessary reserve, will lend the rest of the deposited amount to another person, whereby

the new borrower will deposit the loan with a third bank. The bank also will lend the available amount to another person after deducting the necessary reserve and so on. In such way, the money creation function works. The process of deposits creation increases with lowering the cash reserve ratio that is required by the central bank. Central banks usually control the mandatory reserve ratio that is required from the commercial banks according to the economic situation of the state in case of stagnation or economic viability.

3.1.3 Conventional Banking in the Modern Era

Various economic and political conditions led to new processes in banking, as we know it today. We can find the period between the 19th century and the First World War is characterized by the process of concentration of banks. The period between the first and the Second World War is characterized by bank specialization, whereas the development of modern banking is seen through the process of globalization. This globalization process initiated de-specialization of banking operations whose goal is to create a bank as a universal financial institution that offers all services. The de-specialization process is a precondition for their survival in the globalized financial market and a way to fight off stiff competition from non-bank institutions.

3.2 Starting and Development of Islamic Banking

The area known today as the Arab world has been the cradle of various civilizations since the beginning of history. Where the ancient Egyptian civilization was established in the Nile Valley, the Babylonian civilization and the following in the Mesopotamia, and other civilizations in the Middle East and Africa. It was surrounded by other civilizations of other nations, like the Persian, Greek and Roman. The interaction of these civilizations has resulted in commercial economic activity among their peoples.

3.2.1 Commercial Relations Before Islam

Mecca was a prestigious commercial center in the Arabian Peninsula, in addition to its religious center before the advent of Islam. The merchants of Mecca send their convoys and exchange goods with the Middle East and Yemen. In light of this commercial boom in Mecca and other cities, some forms of banking has emerged. In the field of deposits, the people in Mecca deposited their surplus money with people who knew the trust and honesty in their community. In the field of investment, traders went two ways:

- Invest the money and speculate on a part of the profit,
- Lending money with interest, which was common then, whether among the Arabs themselves or between the Jews living in the Arabian Peninsula at the time, until the Islam came and prohibited it.

Trust among people after Islam continued, so people trust each other over the money and the wealth. It should be noted that the deposit that people knew in the ages before Islam, and then in Islam, was limited to the faithful custody in which the trustee is required to return the same deposit that he received without acting in any way.

3.2.2 The Emergence and development of Islamic Banking

Islamic banks emerged when the first attempt began in a rural area in Pakistan. The first institution was established at the end of the 1950th in the last century, and their duty was to receive deposits and borrow it to the poor farmers without depositors receiving any return from their deposits, nor did the institution receive any returns on the funds it lent. However, this attempt was unsuccessful for many technical reasons and due to the lack of demand to deposit funds in this institution. There was another attempt to establish non- interest institution in the Egyptian countryside. The first local savings bank for labors was established in 1963 in the city of Mit Ghamr, in accordance with Islamic sharia rules. Where banking units were established in each village or neighborhood to collect people's savings under the supervision of the General Organization for Savings, in order to serve their needs in their area. However, this

attempt was unsuccessful as well. After that, there was the establishment of Nasser Social Bank in 1971, which started to operate and receive deposits and make investments. The oil boom in the GCC and Middle East shaped the 1970s, which was one of the main trigger of the rise of Islamic banking. The idea of establishing Islamic banks became a reality after the second conference of Islamic finance ministers in Jeddah in August 1974, where the decision was made to approve the establishment of the Islamic Development Bank. The agreement was made up of 69 articles in nine chapters, whose goal was to promote economic development in Muslim countries and to provide the funds for the development projects in accordance with the rules of Sharia. Then it was followed by the establishment of Dubai Islamic Bank in 1975, and the banks of Faisal Al-Sudani and Al-Masri in 1977.

In the early stages of growth of the Islamic financial market in the 1980s, Islamic banking had faced with the lack of quality investment opportunities, which enabled conventional banks from the west to become mediators in utilizing the funds of Islamic banks. Therefore, Western banks helped Islamic banks to direct the funds in business and trade-related activities. Western banks noticed the significance of Islamic banking markets and started to offer Islamic financial products through so-called Islamic windows, attracting the clients directly, without Islamic banks mediation. Today the world counts over 300 Islamic banks in more than 70 countries, and many international banks offers Islamic financial products. Nowadays, that in many countries there are dual banking systems that comprise of both Conventional banks and Islamic banks. The example of the first country with a dual banking system is the United Arab Emirates, where the bank was established in Dubai in 1973 (Dubai Islamic Bank), that resembled the conventional commercial bank in the way it operated, but without paying and receiving interests.

4 COMPARISON OF CONVENTIONAL AND ISLAMIC MORTGAGES

This chapter includes description of the method multi-criteria decision analysis, which will be used in order to compare mortgages in United Arab Emirates. The first part includes brief description about decision theory, multi-criteria decision analysis (MCDA) and its applications. Then we describe the calculations and interpretation and the result of this thesis in the second part.

4.1 Decision Theory

Decision theory is the theory about making choices; it can be individual or group making choices. Decision theory divided into two types:

- Descriptive theory: it is about how we use these models to understand how people make decisions, and what factors influence their decisions.
- Perspective or normative: we use these models to design rules of how we ought to make decisions and what are the optimal decisions.

In decision theory, we can find the basic participants in this theory:

- decision makers: those who makes decisions,
- values: it is the values of decision makers, and what do they want to achieve,
- decision alternatives: different choices that you have to make choices between,
- uncertainties in the outcomes of these alternatives: it is the consequences of the decision we take. In some cases, it could be certain outcomes, but in most of the cases, it is uncertain outcomes,
- An idea of what is a good decision.

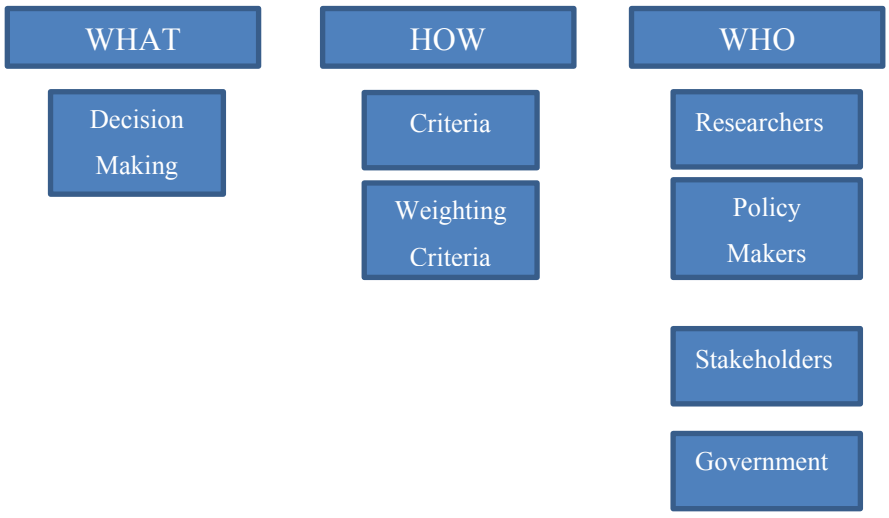
4.2 Multi-Criteria Decision Analysis (MCDA)

Multi-Criteria decision analysis is a formal, structured and transparent decision making methodology. The aim of this analysis is to assist individuals and groups decision makers to explore their decisions in the case of complex situations with multiple criteria.

Multi-Criteria decision analysis assists the decision makers to take a decision by:

- enabling decision makers to gain better understanding of the problem,
- organizing and synthesizing the entire range of information,
- integrating objective measurements with value judgments,
- making explicit and managing the decision maker subjective,
- Ensuring all criteria and decision factors have been taken into account.

Figure 4.1



4.2.1 MCDA Techniques

Criteria Weighing

As an initial step to make our decision in MCDA model, we have to determine criteria weights. Different methods that differ from each other can be used to determine criteria weights. The scales numerically express the meaning of individual criteria. The

resulting scales can be influenced by the method used, but also by the subjective decision of the evaluator. Method for determining criteria weights will be described, namely the analytical hierarchy process (AHP).

Alternatives Evaluation

The aim is to find the best alternative and to determine the advantage of the individual alternative according to the criteria. These methods are generally based on a general nature, which does not depend on the content of each alternative. The solution can be influenced by several factors, such as the choice of weights or the method used. In this subchapter, simple methods for evaluating alternatives will be described, namely the weighted order method and the Saaty method, which are among the methods based on pairwise comparison of variants.

4.2.2 Criteria Weighting, The Analytical Hierarchy Process (AHP)

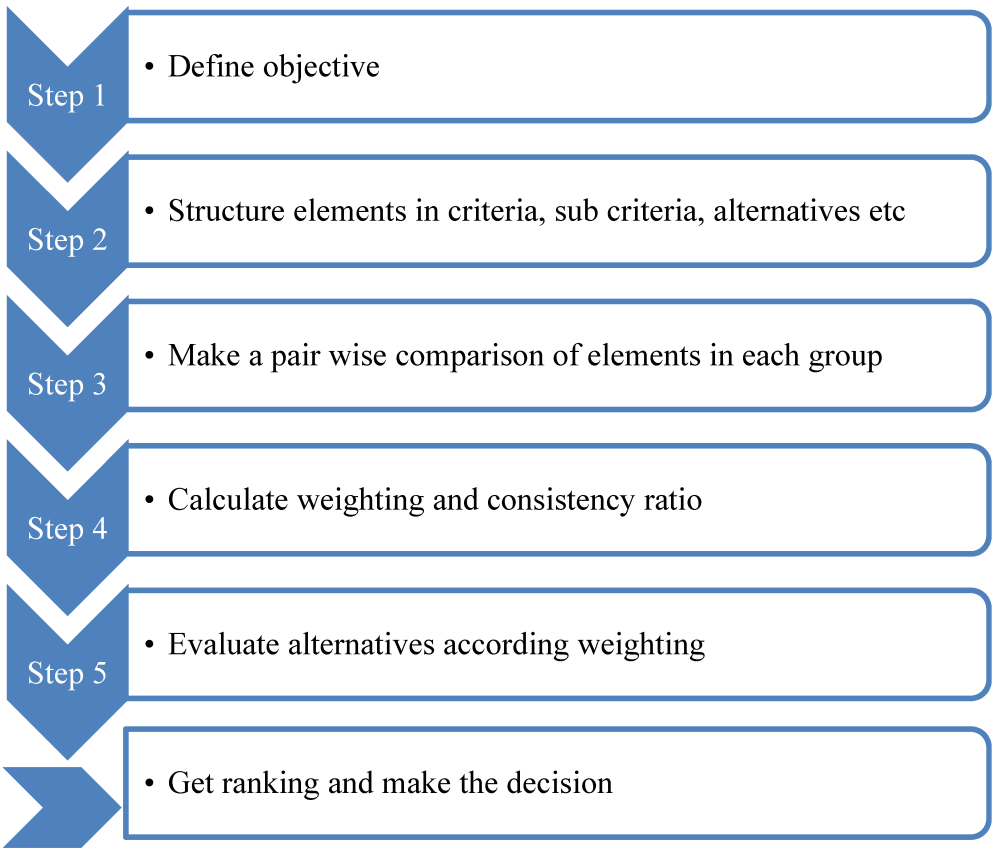
AHP is a combination of Art& Science of decision-making; it can helps to get the insight of the decision problem. It was developed by Thomas L. Saaty in the 1970s. Nowadays, it is the most used MCDA model. AHP uses pairwise comparison method. It generates all criteria weighting and alternatives preference within each criteria by eliciting these values from the decision maker through a series of pairwise comparisons, as opposed to utilizing numerical values directly. Therefore, a complex decision is reduced to a series of simpler ones, between pair of alternatives value within criteria or between pairs of criteria. The decision maker's preference is always explicit. However, the decision maker may be asked to make very many small decisions. Hence, it becomes important to generate an optimized hierarchy of criteria and alternatives to reduce the number of pairwise decisions. Applying AHP allows the factors to be broken down into details, and simplifies the process for identification and assessment of criteria, factors and sub factors related to a project.

4.2.3 How to Apply The AHP Method

To choose a financial product, it is an important to take into account more than one decision criterion in order to find the optimal alternative. To do so, we apply AHP method as described in the following steps:

- **Develop a model for the decision:** Break down the decision into a hierarchy of goals, criteria, and alternatives.
- **Derive priorities (weights) for the criteria:** The importance of criteria are compared pairwise with respect to the desired goal to derive their weights. We then check the consistency of judgments; that is, a review of the judgments is done in order to ensure a reasonable level of consistency in terms of proportionality and transitivity.
- **Derive local priorities (preferences) for the alternatives:** Derive priorities or the alternatives with respect to each criterion separately, compare the alternatives pairwise with respect to each criterion. Check and adjust the consistency as required.
- **Derive Overall Priorities (Model Synthesis):** All alternative priorities obtained are combined as a weighted sum—to take into account the weight of each criterion—to establish the overall priorities of the alternatives. The alternative with the highest overall priority constitutes the best choice.
- **Making a Final Decision:** Based on the synthesis results and sensitivity analysis, a decision can be made. Figure 4.2 illustrates these steps briefly.

Figure 4.2 Applying of AHP Method

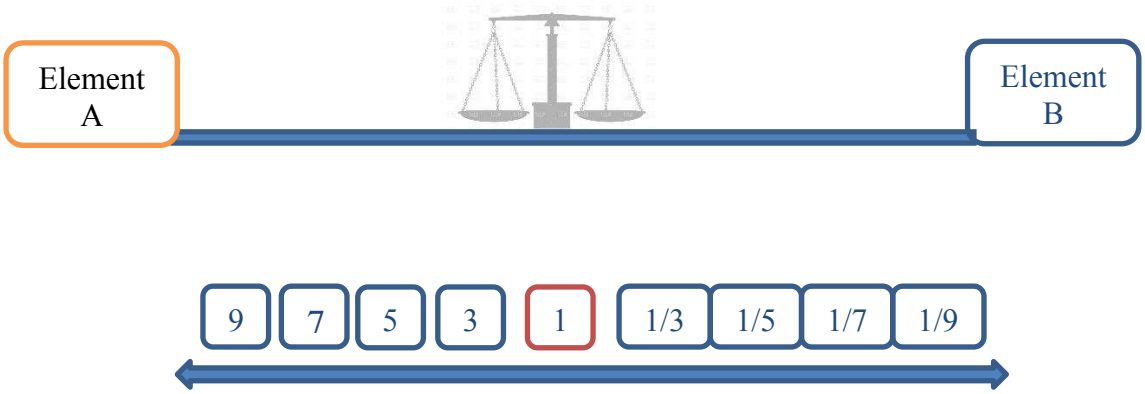


Going back to the second point in applying AHP method, **Derive priorities (weights) for the criteria,** We are required to derive by pairwise comparisons the relative priority of each criterion with respect to each of the others using a numerical scale for comparison developed by Saaty, as shown in Table 4.1 and Figure 4.3. To perform the pairwise comparison we need to create a comparison matrix of the criteria involved in the decision consist of elements $a_{i,j}$. Cells in comparison matrices will have a value from the numeric scale shown in Tab 4.1 and Figure 4.3.

Tab 4.1 Evaluation Scale Interpretation

Intensity of Value	Interpretation
1	Requirements *i* and *j* are equally important
3	Requirement *i* has moderately more importance than *j*
5	Requirement *i* has strongly importance than *j*
7	Requirement *i* has very strongly more importance than *j*
9	Requirement *i* has extremely more importance than *j*
2,4,6,8	These are intermediate scales between two adjacent judgments

Figure 4.3 Evaluation Scale



In the case of requirement, *j* has more importance than requirement *i,* then reciprocal property holds:

$$a_{ji} = \frac{1}{a_{ij}}. \tag{4.1}$$

Then it would be possible to compile Saaty's matrix that has this form:

$$A = \begin{pmatrix} 1 & a_{12} & \dots & a_{1n} \\ 1/a_{12} & 1 & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ 1/a_{1k} & 1/a_{12} & \dots & 1 \end{pmatrix}. \tag{4.2}$$

Before calculating the weights of the individual criteria, it is necessary to verify that the pairing matrix is consistent. The natural assumption for this matrix is that if the

Ki a_{ij} criterion is greater than the criterion *Kj* and the criterion *Kj* is a_{jk} times greater than K_k, where i, j, k ∈ {1, 2,. . . , m}, then the *Ki* criterion should be greater than K_k, where $a_{ik} = a_{ij}a_{jk}$. This expresses the following definitions.

$$a_{ik} = a_{ij}a_{jk} \quad for\ each\ \ i,j,k = 1,2,\dots,m. \tag{4.3}$$

Then we can determine that the matrix A is consistent.

Consistency is measured using the consistency ratio (CR), which was defined by Saaty as follows:

$$CR = \frac{CI}{RI}, \tag{4.4}$$

Where (CI) is the consistency index and (RI) is the random index.

In order to cacluclate consistency index (CI), we use the following formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}, \tag{4.5}$$

Where λmax is the maximum number of the matrix A and n is the number of criteria. The actual array number λmax is determined as follows:

$$\lambda_{max} = \frac{1}{N}\sum_{i}^{N}(A\,.\,\vec{w})_{\,i}/w_i \tag{4.6}$$

The random index index (RI) is determined according to the following table:

Tab. 4.2 Random index

Order	1	2	3	4	5	6	7	8	9	10	11	12	13	14
RI	0	0	0,52	0,89	1,11	1,25	1,35	1,4	1,45	1,49	1,52	1,54	1,56	1,58

Source: Saaty (2010, P. 121).

For simplification, Matrix A is consistent enough if CR < 0, 1.

The least-squares logarithm method is most often used to calculate the weight of the criteria. It is necessary to calculate the geometric mean diameter of the Saaty matrix and thus get *bi* values. For this calculation, we use the following formula:

$$b_i = \sqrt[n]{\prod_{j=1}^{n} a_{ij}}. \tag{4.7}$$

The scales are then calculated by normalizing *bi*:

$$v_i = \frac{b_i}{\sum_{i=1}^{n} b_i}. \tag{4.8}$$

4.2.4 Alternatives Evaluation, - Weighted Sequence Method

Partial alternatives evaluation is determined by the order of alternatives relative to the corresponding criteria:

$$h_i^j = m + 1 - p_i^j, \tag{4.9}$$

p_i^j is the order of j alternative relative to i criteria, m is the number of alternatives.

Evaluation is based only on order of alternatives; it does not reflect the differences between the values of the criteria. This method is suitable only for qualitative criteria.

4.2.5 Alternatives Evaluation, Saaty's Method

Saaty's method should be used if qualitative criteria predominate in the mixed set. The aggregate evaluation of the alternatives is determined as the weighted sum of the individual alternatives for the given criteria as shown by the following relation:

$$H^j = \sum_{i=1}^{n} v_i \,.\, h_i^j; \qquad j = 1, 2, \dots, m\,, \tag{4.10}$$

Where H^j is the total score for the value of the j alternative, v_i is the weight of the i-th criterion, h_i^j is the individual evaluation of the jth alternative for the i-th criterion, n is the number of evaluation criteria and m is the number of alternatives.

The determination of the individual evaluation of the alternatives for the partial criteria is similar to Saaty's method of determining the weights, except that the decision alternatives are compared instead of the criteria. For each criterion, a Saaty matrix is created based on the pairwise comparison of alternatives. Gradually, the size of the preference of each pair of alternatives is determined by assigning the number of points from the nine-step scale. The parts of the sub matrices then correspond to the variance ratios between each other.

4.3 Comparison of Mortgages in UAE

A large number of various conventional and Islamic financial institutions are active on present financial markets. Their main goal is to attract more clients by competing in offering different financial services and products. While the potential clients take the responsibility to choose the appropriate and right products, which will determine their financial relations and plans with the chosen bank. To take the right decision in choosing the right product, clients would take in consideration different factors, which might influence their decision, for example: interest rates, fees, offers and services are provided by the potential bank…etc.

The present comparison aims to determine the most appropriate mortgage for our client, in the case of United Arab Emirates (UAE).

4.3.1 Client Profile

Nawar, is an expat employee in Dubai, she has monthly salary of 15,000 AED. She is willing to buy new studio flat. The flat is situated in IMPZ area in Dubai; it has

gross area of 65 square meter for a price of 500,000 AED. She is confused between the different mortgages in the market. In the following parts, we will compare and determine the best mortgage for Nawar according to different criteria the client will take in consideration.

4.3.2 Mortgages in UAE

In UAE, there are different types of Mortgages**:** mortgages are categorized based on how interest is charged. The two types of mortgages in UAE are:

- **Floating-rate mortgages:** The interest payable on the mortgage can change based on certain parameters (ideally EIBOR). These are also called Variable-rate mortgages (EIBOR stands for Emirates InterBank Offered Rate. This determines the interest rate to be charged by the banks for the loans provided). EIBOR is often used as a benchmark for mortgage variable rates, which means that he rate being charged is set at EIBOR plus a percentage margin on top.
- **Fixed-rate mortgages:** The interest payable on the mortgage is fixed for the entire tenure of the loan.

In this comparison, all interest rates are adjusted to equivalent flat rate. The calculation used is a division of the reducing rate by 1.814 and this is indicative only.

4.3.3 Alternatives Selection

Within this model example, we have chosen 10 banks who operates in UAE. Five banks who provide conventional mortgages and five banks who provide Islamic mortgages. These banks were selected based on their reputation in the market and the availability of mortgages to expats in UAE.

List of the chosen banks in Tab 4.3.

Tab. 4.3 Alternatives Selection

Alternatives	Bank Name
V1	Emirates NBD
V2	Abu Dhabi Commercial Bank
V3	HSBC
V4	Mashreq Bank
V5	RAK Bank
V6	Dubai Islamic Bank
V7	Abu Dhabi Islamic Bank
V8	Noor Islamic Bank
V9	Emirates Islamic Bank
V10	Al Hilal Bank

4.3.4 Decision Making Criteria

Determining criteria is a key step in the multi-criteria analysis. There should not be too many to avoid unnecessary confusion and therefore, in the model example, the following criteria were selected:

- minimum salary required (k1),
- interest rate (k2),
- down payment (k3),
- process fees (k4),
- property insurance (k5),
- the availability and easiness of getting the information through banks websites (k6),
- first payment due (k7).

In order to get mortgages in UAE, one of the most important criterion for expatriates who lives there is the minimum salary required by the bank. Because this criterion is the most important to determine their eligibility to get the mortgage. We rank the value among the criteria, which means that the lowest value is required. We will set a scale in the range 1-9, where number 9 stands the lowest minimum salary required, and number 1 will represent the highest value.

For the majority of people, the purchase of a home is the single largest financial transaction of their lives, and since most people are not able to fund the price of a home with their own personal funds, a loan from either a conventional bank or an Islamic bank is normally required. Mortgages are usually a large and long-term transaction. Hence, interest rate criterion was important to determine this long-term relation between the bank and the client as it will fix the price of this transaction. We rank the interest rate among the criteria, which means that the lowest interest rate is required. We will set a scale in the range 1-9, where number 9 stands the lowest interest, and number 1 will represent the highest interest rate.

For the client, it is also crucial to find the appropriate down payment required, so the client would be able to determine his ability to settle this payment at the very beginning of the mortgage payments. Again, the lowest down payment rate is desirable on scale from in the range 1-9, where number 9 stands the lowest down payment rate, and number 1 will represent the highest value. .

Every bank has its own procedures to process the mortgage application. These procedures cost banks money and this cost vary from one to the other. Therefore, they ask the client to pay some fees what so called process fees. The minimum process fees is the most desirable in order to reduce the loan payments of the client. Again, on a scale in the range 1-9, where number 9 stands the lowest process fees required, and number 1 will represent the highest value.

Mortgage lenders require homeowners to carry property insurance. The reason behind it is that bank will want your home rebuilt in case of catastrophe. We will set a scale in the range 1-9, while 9 is the best and 1 is the worst. Some banks provide this type of insurance as a whole package along with the mortgage, while the price is included in the mortgage payments, this type will get high ranking. Other banks would ask for separate fees for this type of insurance and this type will get medium ranking based on the fees. On the other hand, some banks would require it but the client will hold the responsibility to carry this insurance policy from insurance company, and this type will get the lowest ranking due to the risk of high insurance prices.

The availability of the mortgages information on the website it is an important thing, especially in UAE where expatriates working hours are long and it is crucial to have a visit to different banks to check the conditions of mortgages. This is a qualitative criterion, we will set a scale in the range 1-9, where number 9 stands for the availability and good structure of website, while number 1 represent the incomplete information and complicated websites.

When buying a home through mortgage, there will be a date on which to close the mortgage. On the closing day, the loan starts and the transaction is completed. Normally, the first mortgage payment will be due one month after the last day of the month the mortgage close. Some banks offer some privileges to their clients to postpone the first payment due to some months later, after the mortgage close. We will set scale in range 1-9, while 9 stands for the banks who offer highest grace period and 5 stands for banks who offer medium grace period and 1 stands for banks who don't offer any grace period.

The following Tab 4.4 illustrates the requirements to obtain mortgage loans from five banks who provides conventional mortgage loans in UAE.

The majority of conventional banks, which listed below, have the same down payment and requirement of minimum salary required, while the interest rate vary among them. Moreover, all of them they do not provide grace period for the first payment due.

Tab. 4.3 Conventional Mortgages Requirements

Banks provides conventional mortgages	Conventional mortgages requirements						
	Min. salary (k1)	Flat interest rate (k2)	Down payment (k3)	Process fees (k4)	Property insurance (k5)	Availability of information (k6)	First Payment due (k7)
Emirates NBD V 1	10,000 AED	2.2% p.a.	25% to 35%	0.05% p.a.	Up to 0.036% p.a.	Not enough information	No grace period
Abu Dhabi Comme...	15,000 AED	2.75% p.a.	25%	1%	0.048% p.a.	Not enough information	No grace period
HSBC V 3	15,000 AED	1.8% p.a.	25%	1%	0.04% p.a.	All information is provided online	No grace period
Mashreq Bank V 4	15,000 AED	2.99%	25%	1%	Required but not included	Not enough information	No grace period
RAK Bank V 5	15,000 AED	1.65%	25%	1% to 1.40%	0.035% p.a.	All information is provided online	No grace period

The following Tab 4.5 will illustrate the requirements to obtain mortgage loans from five banks in UAE who provides Islamic mortgage loans.

Tab 4.5 Islamic Finance Mortgages Requirements

Banks provides Islamic mortgages	Islamic finance (mortgages) requirements						
	Min. salary (6k1)	Flat interest rate (k2)	Down payment (k3)	Process fees (k4)	Property insurance (k5)	Availability of information (k6)	First Payment due (k7)
Dubai Islamic Bank V6	12,000 AED	1.79% p.a.	25%	1%	Up to 0.036% p.a.	All information is provided online	No grace period
Abu Dhabi Islamic Bank (ADIB) V 7	15,000 AED	2.06% p.a.	25%	0%	Included	Not enough information	Up to 6 months grace period
Noor Islamic Bank V 8	10,000 AED	2.04% p.a.	25%	1%	Included	Not enough information	Up to 2 months grace period
Emirates Islamic Bank V 9	15,000 AED	1.63% p.a.	25%	1%	0.035% p.a.	All information is provided online	Up to 2 months grace period
Al Hilal Bank V 10	15,000 AED	1.93% p.a.	25% to 35% subject to property value	1%	Included	All information is provided online	No grace period

Again, the majority of Islamic banks have the same requirement for down payment, while they vary in interest rate required and the grace period that provided.

4.3.5 Computing The Vector of Criteria Weights

In order to calculate the vector of criteria weights, we use Saaty's method. It is necessary first to sort the criteria into a table according to their importance. The rows

and columns are the criteria mentioned previously. Consequently, a couple of criteria are compared and the most important ones are identified. In addition, the Saaty method determines the importance of this preference, that is, the number of times one criterion is more important than the other. We use Saaty's nine-point scale which been mentioned previously in Tab 4.1 and Figure 4.3.

Table 4.6 shows the matrix of the preferences for the individual criteria.

Tab 4.6: Saaty's matrix

	k1	**k2**	**k3**	**k4**	**k5**	**k6**	**k7**
k1	1	3	5	5	6	7	8
k2	0.33	1	4	5	5	6	7
k3	0.20	0.25	1	3	4	4	5
k4	0.20	0.20	0.33	1	3	3	4
k5	0.17	0.20	0.25	0.33	1	3	3
k6	0.14	0.17	0.25	0.33	0.33	1	0.33
k7	0.13	0.14	0.20	0.25	0.33	3.00	1

Subsequently, we calculate the geometric mean of Saaty matrix according to (4.7). After that, we calculate the weights of each criterion using (4.8). The results of these calculations are shown in Tab. 4.7.

Tab 4.7: Determination of weights using Saaty's method

Criterion	**k1**	**k2**	**k3**	**k4**	**k5**	**k6**	**k7**	**Total**
Geometric mean	4.254	2.815	1.426	0.900	0.590	0.300	0.367	10.653
Criterion weight	0.399	0.264	0.134	0.085	0.055	0.028	0.034	1
Order	**1**	**2**	**3**	**4**	**5**	**7**	**6**	

The final step is to check the consistency of the matrix according to (4.4), (4.5) and (4.6) as following (the complete results of I max is listed in Annexes 1):

CI	0.12743
CR	0.094393

CR < 0, 1 ➡ the matrix is consistent.

From Tab. 4.7 it can be noted that criterion k1 - the minimum salary required, has the highest weight, on the contrary, the criterion k6 – availability of information, has the lowest weight. Since Saaty's method is among the most accurate methods of weighting the criteria, it will be used in the assessment of alternatives by the weighted sequence method in subchapter 4.3.6 alternatives evaluation.

4.3.6 Evaluation of Alternatives According to Criteria

The aim of this subchapter is to find the most advantageous alternative (bank) for the client through two methods of multi-criteria evaluation of alternatives. First, the alternative will be compared by the weighted sequence method and finally by Saaty's method of evaluating the alternatives. At the end of the subchapter, the results of the individual methods will be compared.

Weighted Sequence Method

In this method, the alternatives are scored by the decision-maker with relative to the criteria, using an interval scale (1 – 10), 10 is the most important.

Tab 4.8: Weighted sequence method - partial variance evaluation

Weighting sequence method - partial variance evaluation							
Alternatives / Criterion	**k1**	**k2**	**k3**	**k4**	**k5**	**k6**	**k7**
v1	10	6	4	8	9	5	1
v2	1	2	8	3	1	5	1
v3	1	8	8	3	5	10	1
v4	1	1	8	3	1	5	1
v5	1	10	8	1	10	10	1
v6	6	8	8	3	9	10	1
v7	1	7	8	10	10	5	10
v8	10	7	8	3	10	5	6
v9	1	10	8	3	10	10	6
v10	1	7	4	3	10	10	1

The next step of the weighted sequence method is to multiply the evaluations of the alternatives according to criteria from Tab. 4.8, and the individual criteria, which were determined by Saaty's method. The weights are shown in Tab. 4.7.

The final evaluation of alternatives is given by the sum of all partial evaluations multiplied by weights. The last step is the descending ordering of the alternatives, with the highest value being determined as the most advantageous.

The partial evaluation of alternatives multiplied by weights, their sum and the order of each alternative is shown in Tab. 4.9.

Tab 4.9: Alternatives evaluation using weighted sequence method

The complete evaluation of all alternatives									
Alternatives / Criterion	**k1**	**k2**	**k3**	**k4**	**k5**	**k6**	**k7**	**Total**	**Order**
v1 - Emirates NBD	3.9931	1.5854	0.5355	0.6762	0.4988	0.1410	0.0344	7.4645	**2**
v2 - Abu Dhabi Commercial Bank	0.3993	0.5285	1.0710	0.2536	0.0554	0.1410	0.0344	2.4832	**9**
v3 – HSBC	0.3993	2.1139	1.0710	0.2536	0.2771	0.2819	0.0344	4.4313	**7**
v4 - Mashreq Bank	0.3993	0.2642	1.0710	0.2536	0.0554	0.1410	0.0344	2.2190	**10**
v5 - RAK Bank	0.3993	2.6423	1.0710	0.0845	0.5542	0.2819	0.0344	5.0678	**6**
v6 - Dubai Islamic Bank	2.3959	2.1139	1.0710	0.2536	0.4988	0.2819	0.0344	6.6495	**3**
v7 - Abu Dhabi Islamic Bank	0.3993	1.8496	1.0710	0.8453	0.5542	0.1410	0.3443	5.2048	**5**
v8 - Noor Islamic Bank	3.9931	1.8496	1.0710	0.2536	0.5542	0.1410	0.2066	8.0691	**1**
v9 - Emirates Islamic Bank	0.3993	2.6423	1.0710	0.2536	0.5542	0.2819	0.2066	5.4090	**4**
v10 - Al Hilal Bank	0.3993	1.8496	0.5355	0.2536	0.5542	0.2819	0.0344	3.9086	**8**

From Tab. 4.9 it shows that the most advantageous alternative according to the weighted sequence method is the mortgage from Noor Islamic bank, on the contrary, the worst is the mortgage from Mashreq bank. The second best option is the mortgage from Emirates NBD, and the third most advantageous was the mortgage from Abu Dhabi Islamic Bank (ADIB). The order of the individual alternatives within this method is greatly influenced by criterion k1 - the minimum salary required, so the most important is how much minimum salary the bank would require to get mortgage. As much as it is lower, it means that the mortgage more available to potential clients with low salaries. The second influencer was k2 – interest rate, because it will determine the price of this mortgage and the whole relation with the chosen bank.

Saaty's Method

Saaty's multi-criteria alternatives assessment method has a similar procedure to Saaty's method (AHP) of criteria weighting, which was described in subchapter 4.2.3. However, in this case, criteria are not compared, but alternatives of decision-making. In this method, the Saaty matrix is first created, which compares each alternative with respect to the criteria. The first matrix and all associated tables will be mentioned below, and the rest of matrices are listed in Annexes. Saaty matrix illustrate differences in importance between alternatives values within a given criterion. The most important alternative is the one with the highest value. Using the nine-point scale to judge the preferences between the alternatives, the alternatives will be paired.

Tab 4.10: Saaty matrix for partial evaluation of criterion k1

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	8.00	8.00	8.00	8.00	3.00	8.00	1.00	9.00	9.00
v2	0.13	1.00	1.00	1.00	1.00	0.20	0.13	0.13	1.00	1.00
v3	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00
v4	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00
v5	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00
v6	0.33	5.00	5.00	5.00	5.00	1.00	5.00	0.33	5.00	5.00
v7	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00
v8	1.00	8.00	8.00	8.00	8.00	3.00	8.00	1.00	8.00	8.00
v9	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00
v10	0.13	1.00	1.00	1.00	1.00	0.20	1.00	0.13	1.00	1.00

In the table below, the geometric mean of the alternatives (GM) calculated according to (4.7) and the partial evaluation of the alternatives within the given criterion (PE), which were determined according to (4.8).

Tab 4.11: Partial evaluation of variants according to criteria k1

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	4.899	0.456	0.562	0.562	0.562	2.477	0.562	4.785	0.562	0.566	15.99
PE	0.306	0.029	0.035	0.035	0.035	0.155	0.035	0.299	0.035	0.035	1

The consistency of all matrices are verified according to (4.4) and (4.5).

CI	0.002299682
CR	0.001585987

CR < 0, 1 ⟹ the matrix is consistent.

The partial evaluation of alternatives according to criterion k2 is shown in Tab. 4.12.

Tab 4.12: Partial evaluation of alternatives according to criteria k2

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	0.766	0.273	1.669	0.207	2.56	1.669	1.096	1.095	2.361	1.095	12.79
PE	0.06	0.021	0.131	0.016	0.2	0.131	0.086	0.086	0.185	0.086	1

To verify the consistency of the matrix:

CI	0.022729885
CR	0.015675782

CR < 0, 1 ⟹ the matrix is consistent.

The partial evaluation of alternatives according to criterion k3 is shown in Tab. 4.13.

Tab 4.13: Partial evaluation of alternatives according to criteria k3

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	0.189	1.516	1.516	1.516	1.516	1.516	1.516	1.516	1.516	0.196	12.51
PE	0.015	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.121	0.016	1

To verify the consistency of the matrix:

CI	0.003544183
CR	0.002444264

CR < 0, 1 ⟹ the matrix is consistent.

The partial evaluation of alternatives according to criterion k4 is shown in Tab. 4.14.

Tab 4.14: Partial evaluation of alternatives according to criteria k4

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	3.497	0.763	0.763	0.763	0.412	0.763	4.625	0.763	0.763	0.764	13.87
PE	0.252	0.055	0.055	0.055	0.03	0.055	0.333	0.055	0.055	0.055	1

To verify the consistency of the matrix:

CI	0.008142667
CR	0.005615632

CR < 0, 1 ⟹ *the matrix is consistent*

The partial evaluation of alternatives according to criterion k5 is shown in Tab. 4.15.

Tab 4.15: Partial evaluation of alternatives according to criteria k5

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	1.165	0.209	0.53	0.209	2	1.165	2	2	2	2	13.28
PE	0.088	0.016	0.04	0.016	0.151	0.088	0.151	0.151	0.151	0.151	1

To verify the consistency of the matrix:

CI	0.015537048
CR	0.010715205

CR < 0, 1 ⟹ *the matrix is consistent*

The partial evaluation of alternatives according to criterion k6 is shown in Tab. 4.16.

Tab 4.16: Partial evaluation of alternatives according to criteria k6

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	0.5	0.5	2	0.5	2	2	0.5	0.5	2	2	12.5
PE	0.04	0.04	0.16	0.04	0.16	0.16	0.04	0.04	0.16	0.16	1

To verify the consistency of the matrix:

CI	0.015999458
CR	0.011034109

CR < 0, 1 ⟹ the matrix is consistent

The partial evaluation of alternatives according to criterion k7 is shown in Tab. 4.17.

Tab 4.17: Partial evaluation of alternatives according to criteria k7

Var	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	Total
Gm	0.589	0.589	0.589	0.589	0.589	0.589	5.341	2.764	2.764	0.589	14.99
PE	0.039	0.039	0.039	0.039	0.039	0.039	0.356	0.184	0.184	0.039	1

To verify the consistency of the matrix:

CI	0.006218458
CR	0.004288591

CR < 0, 1 ⟹ the matrix is consistent

The next step of Saaty's method is to calculate the aggregate evaluation of alternatives according to (4.7). Eventually, the individual alternatives are sorted in descending order according to this aggregate valuation, the most advantageous alternative being the one whose aggregate valuation reaches the highest value. In Tab. 4.12 shows the aggregate ranking and the order of each alternative.

Tab 4.10: Evaluation of alternatives using Saaty's method

Alternatives	**Rating**	**Order**
v1 - Emirates NBD	0.168836867	**2**
v2 - Abu Dhabi Commercial Bank	0.041082094	**10**
v3 - HSBC	0.077569857	**7**
v4 - Mashreq Bank	0.04241574	**9**
v5 - RAK Bank	0.0998693	**6**
v6 - Dubai Islamic Bank	0.128142624	**3**
v7 - Abu Dhabi Islamic Bank	0.102562485	**5**
v8 - Noor Islamic Bank	0.178490108	**1**
v9 - Emirates Islamic Bank	0.103092918	**4**
v10 - Al Hilal Bank	0.057938007	**8**

4.3.7 Summary of Alternatives Evaluation

Since two multi-criteria analyses were used in the evaluation of alternatives, it is necessary to compare the results of the individual methods. Each alternative will use the arithmetic mean to determine the average order of the alternatives, and then the individual alternatives will be sorted according to the specified average order. The order of alternatives, the average order of alternatives and the overall order of each alternative is shown in Tab. 4.11.

Tab 4.11: Summary of Alternatives Evaluation

Alternatives	Weighted Sequence Method	Saaty's Method	Average Order	Overall Order
v1 - Emirates NBD	2	2	2	2
v2 - Abu Dhabi Commercial Bank	9	10	9.5	9-10
v3 – HSBC	7	7	7	7
v4 - Mashreq Bank	10	9	9.5	9-10
v5 - RAK Bank	6	6	6	6
v6 - Dubai Islamic Bank	3	3	3	3
v7 - Abu Dhabi Islamic Bank	5	5	5	5
v8 - Noor Islamic Bank	1	1	1	1
v9 - Emirates Islamic Bank	4	4	4	4
v10 - Al Hilal Bank	8	8	8	8

From previous table we can find that the best choice to obtain mortgage is from Noor Islamic bank, as it got the first ranking. Second best choice in ranking is Emirates NBD. While the last two choices in ranking were Abu Dhabi commercial bank and Alhilal bank which they got the 9^{th} and 10^{th} ranking.

4.3.8 Comparison Results

The first step in determining the optimal alternative was to determine the weights of the criteria. To determine the weights of criteria we used Saaty's method, the results are shown in Tab. 4.12.

Tab 4.12: Summary of individual criteria weights

Criterion	Criterion weight	Order
k1	0.399	**1**
k2	0.264	**2**
k3	0.134	**3**
k4	0.085	**4**
k5	0.055	**5**
k6	0.028	**7**
k7	0.034	**6**

The weights of the individual criteria are in the order from 1 which is the most important to 7 which is the less important. The first criterion is assigned a greater weight by 0.135 compared to the second criterion, and greater weight by 0.365 compared to the last criterion. Due to the fact that the first criterion k1, the minimum salary required, is the most important as it can be the reason that makes the client eligible to obtain a mortgage from the bank or not. Then the second important criterion k2, interest rate, as it can determine the price of this mortgage and how much installments the client would pay for many years. The least important criterion was k6, availability of information.

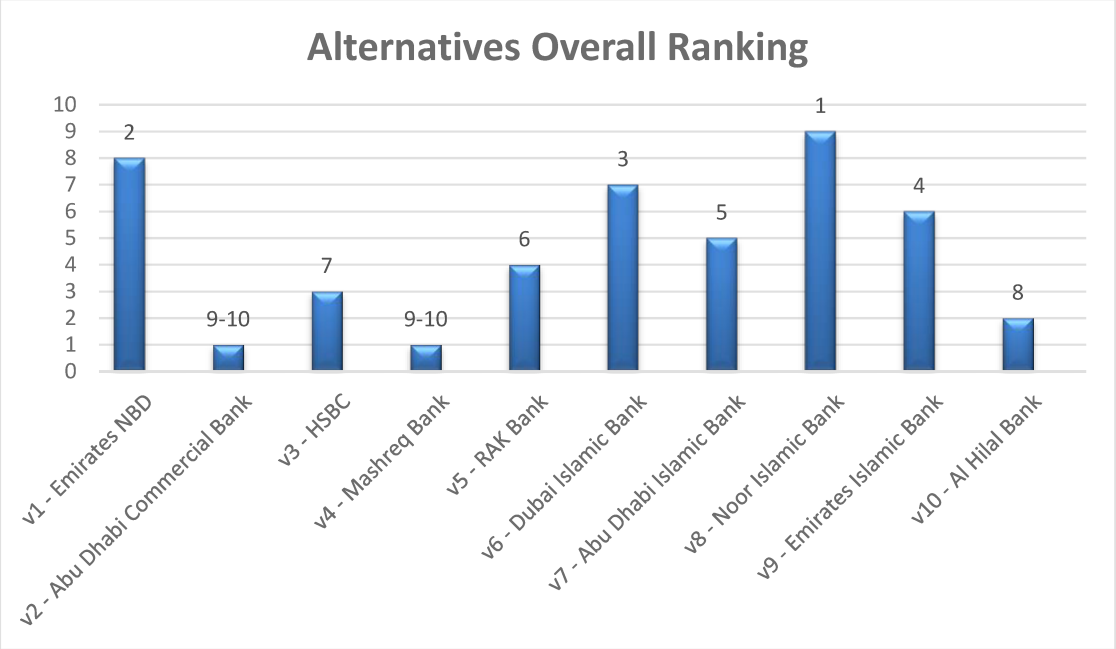
To evaluate alternatives, weighted sequence method and Saaty's evaluation methods were used. Weight sequence took in consideration weights which been computed previously. While in Saaty's method, we used pairwise comparison between alternatives. Tab 4.13 shows the average order and ranking of alternatives.

Tab 4.13: Average and overall ranking of alternatives

Alternatives	Average Order	Overall Order
v1 - Emirates NBD	**2**	**2**
v2 - Abu Dhabi Commercial Bank	**9.5**	**9-10**
v3 – HSBC	**7**	**7**
v4 - Mashreq Bank	**9.5**	**9-10**
v5 - RAK Bank	**6**	**6**
v6 - Dubai Islamic Bank	**3**	**3**
v7 - Abu Dhabi Islamic Bank	**5**	**5**
v8 - Noor Islamic Bank	**1**	**1**
v9 - Emirates Islamic Bank	**4**	**4**
v10 - Al Hilal Bank	**8**	**8**

Graph 4.1 demonstrates the average ranking of alternatives, taking in consideration both methods. While Noor bank is the best choice as it has got the first ranking, and on the contrary, Abu Dhabi commercial bank and Mashreq bank have got the last choice and last ranking.

Graph 4.1: Alternatives Overall Ranking



As a final result of our comparison, it would be advisable as the optimal choice for client Nawar to apply for mortgage through Noor Islamic Bank, because it got the best ranking in our comparison according to the chosen criteria. While this choice demonstrates the lowest minimum salary required along with Emirates NBD bank, between the chosen banks. This criterion has played main role in choosing the mortgage and the bank. In addition, the low interest rate, and the property insurance, which is included in the price and the availability of a grace period were the reasons behind Noor Islamic Bank the best-ranked mortgage in this analysis.

The multi-criteria analysis is influenced by the decision maker, because each decision maker influences the results with their priorities in selecting evaluation criteria and other methods for evaluating alternatives. Therefore, the overall result is affected by the decision-maker's subjective decision.

5 Conclusion

This thesis was focused on the comparison of conventional and Islamic finance, and finding the optimal mortgage for individuals pursuing to finance their own housing. As there are many financing options in the market and each of the lenders is trying to sell their product, it is difficult for consumers to find the optimal product.

The aim of this thesis was to give a comprehensive comparison between conventional and Islamic finance. And to compare between different conventional and Islamic mortgages in UAE; in order find the optimal option of mortgage for a defined physical person, based on MCDA methodology

The thesis was divided into five chapters, with an introductory first chapter and a concluding final chapter. The second and third chapters contained the theoretical section and the fourth chapter was devoted to the practical part

In the second chapter, conventional and Islamic banking were characterized. First, the main principles of conventional banking systems, their process and features, categories, types and services of banks were described. After that, there was a detailed description of the basis of Islamic law, and the main principles of the Islamic banking system, their process and features, and description of contracts in Islamic finance. In addition, at the end of second chapter, there was a comparison of differences and similarities between these two banking systems.

The third chapter was devoted to demonstrate an overview of the historical start of conventinal and Islamic banking. First, there was a description of commercial relations in the communities that existed. Then its followed by description of the commercial relations in the communities in the Arabian Peninsula, Middle East and Africa before and after Islam, and the last part was description of historical stages of establishing the Islamic banking, and description of their development in the history.

The fourth chapter contains the practical part of the bachelor thesis. Using an application of multi-criteria analysis methods, Nawar, an expatriate employee in Dubai, UAE, was identified as a defined client who earns 15,000 AED and is looking for the

best option to finance a purchase of an apartment in IMPZ area in Dubai for a price of 600,000 AED. For the assessment of the alternatives, 7 criteria were defined, the minimum salary required, interest rate, down payment, process fees, property insurance, availability of information and first payment due. Further, we have evaluated the alternatives based on weighted sequence method and Saaty's method. Followed by comparison between the average results and ranking.

By comparing conventional and Islamic banking systems, we can find that these two systems have similarities in theory and practice. When we talk about the characteristics and structures of both of these systems, it would show the differences in theories and aims of these two systems. Moreover, in Islamic banking, they use their conventional Arabic terminologies, which have been extracted from Islamic ruling to give a particular name to their provided products for financing, i.e. Ijara, Musharaka, Murabaha.

When we compared the pricing and requirements issues of mortgages in both types of banks, it is revealed that they are both almost the same to some extent. From the customer's point of view, they both look the same, in that the customer has to pay his monthly installments by the end of the mortgage period.

Religious view can affect the decision of the potential client. Some clients would not accept to deal with conventional banks or vice versa, due to their religious views, even in the case of some advantages in the prices or requirements. On the other hand, it could be the Islamic financial system is attractive to non-Muslims because of some advantages in pricing and monthly installment rates. They find it easier to meet their monthly budget instead of paying a variable monthly rate. The fact that it is religion-compliant is not an issue for non-Muslims in many cases.

The comparison between mortgages in UAE shows that the conditions, pricing and requirements of these mortgages have varied by a small percentage, which make it harder to the client to make the decision by choosing the appropriate product. In UAE, there are more than 180 nationalities and many religious views. Which make it important to have different kind of products and providers who are able to meet the different clients' needs. Moreover, this would reflect the high competitive banking environment

in a country such UAE, which depends primarily on investments, oil and banking sector which are considered as the artery of financial development in UAE.

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List of Abbreviations

AAOIFI	The Accounting and Auditing Organization for Islamic Financial Institutions
AED	Dirham currency
AHP	The Analytical Hierarchy Process
GCC	Gulf Cooperation Council
MCDA	Multi-Criteria Decision Analysis
UAE	United Arab Emirates

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Ostrava dated 23/4/2018

Jaroslav Palička

Student's name and surname

List of Annexes

Annexes

Annex 1: Criteria Weight, Geometric Mean, Criterion Weight and I max results

Geometric mean	Criterion weight	I max	Average
4.253745531	0.399312993	3.08938	7.736738
2.814795592	0.26423406	2.042779	7.730946
1.426161635	0.133878453	1.039999	7.768232
0.900457115	0.084528852	0.650432	7.694787
0.590383603	0.055421238	0.424339	7.656619
0.30034343	0.028194219	0.220874	7.834028
0.366773057	0.034430185	0.273056	7.930725
10.65265996	1		**7.764582**

Annex 2: Partial evaluation of Alternatives according to criterion k1, Geometric Mean and I max results

Geometric mean	Criterion weight	I max	Average
4.898979486	0.306354863	3.057121168	9.979019545
0.456221768	0.028529566	0.315488391	11.05829627
0.561674881	0.035124016	0.346221904	9.857127647
0.561674881	0.035124016	0.346221904	9.857127647
0.561674881	0.035124016	0.346221904	9.857127647
2.476593633	0.154872358	1.554482786	10.0371868
0.561674881	0.035124016	0.346221904	9.857127647
4.784924795	0.299222519	2.986596536	9.981189075
0.561674881	0.035124016	0.346221904	9.857127647
0.566098065	0.035400617	0.349249791	9.865641436
15.99119215	1		**10.02069714**

Annex 3: Saaty matrix for partial evaluation of of Alternatives according to criterion k2, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	4.00	0.50	5.00	0.33	0.50	0.50	0.50	0.33	0.50
v2	0.25	1.00	0.17	2.00	0.14	0.17	0.20	0.20	0.14	0.20
v3	2.00	6.00	1.00	7.00	0.50	1.00	2.00	2.00	0.50	2.00
v4	0.20	0.50	0.14	1.00	0.13	0.14	0.17	0.17	0.13	0.17
v5	3.00	7.00	2.00	8.00	1.00	2.00	3.00	3.00	1.00	2.00
v6	2.00	6.00	1.00	7.00	0.50	1.00	2.00	2.00	0.50	2.00
v7	2.00	5.00	0.50	6.00	0.33	0.50	1.00	1.00	0.50	1.00
v8	2.00	5.00	0.50	6.00	0.33	0.50	1.00	1.00	0.50	1.00
v9	3.00	7.00	2.00	8.00	1.00	2.00	2.00	2.00	1.00	2.00
v10	2.00	5.00	0.50	6.00	0.33	0.50	1.00	1.00	0.50	1.00

Geometric mean	**Criterion weight**	**I max**	**Average**
0.76588533	0.059876551	0.613399152	10.24439681
0.272619013	0.021313225	0.218553891	10.25437921
1.669286681	0.13050404	1.328270212	10.17800072
0.20745171	0.016218476	0.16703824	10.29925613
2.560142727	0.200150743	2.050319125	10.24387469
1.669286681	0.13050404	1.328270212	10.17800072
1.095958226	0.085681494	0.870003672	10.15392747
1.094857305	0.085595424	0.869336503	10.15634319
2.360727863	0.184560583	1.879042207	10.18116748
1.094857305	0.085595424	0.869336503	10.15634319
12.79107284			**10.20456896**

Annex 4: Saaty matrix for partial evaluation of of Alternatives according to criterion k3, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1.00
v2	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v3	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v4	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v5	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v6	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v7	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v8	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v9	8.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00
v10	1.00	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	1.00

Geometric mean	**Criterion weight**	**I max**	**Average**
0.189464571	0.015144201	0.151924721	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
1.515716567	0.121153611	1.215397764	10.031874
0.195503565	0.015626908	0.156770865	10.03211047
12.51070067	1		**10.03189765**

Annex 5: Saaty matrix for partial evaluation of of Alternatives according to criterion k4, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	5.00	5.00	5.00	7.00	5.00	0.50	5.00	5.00	5.00
v2	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00
v3	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00
v4	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00
v5	0.14	0.50	0.50	0.50	1.00	0.50	0.13	0.50	0.50	0.50
v6	0.20	1.00	1.00	1.00	2.00	1.00	0.17	1.00	1.00	1.00
v7	2.00	6.00	6.00	6.00	8.00	6.00	1.00	6.00	6.00	6.00
v8	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00
v9	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00
v10	0.17	1.00	1.00	1.00	2.00	1.00	0.20	1.00	1.00	1.00

Geometric mean	Criterion weight	I max	Average
3.49692089	0.252040502	2.551086336	10.1217317
0.762765206	0.054976287	0.552950082	10.05797436
0.762765206	0.054976287	0.552950082	10.05797436
0.762765206	0.054976287	0.552950082	10.05797436
0.411585627	0.029665026	0.299811239	10.10655586
0.762765206	0.054976287	0.550239715	10.00867372
4.62506535	0.333351491	3.384410591	10.15267873
0.762765206	0.054976287	0.552950082	10.05797436
0.762765206	0.054976287	0.552950082	10.05797436
0.764277178	0.055085262	0.553790217	10.05332818
13.87444028			**10.073284**

Annex 6: Saaty matrix for partial evaluation of of Alternatives according to criterion k5, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	7.00	3.00	7.00	0.50	1.00	0.50	0.50	0.50	0.50
v2	0.14	1.00	0.25	1.00	0.13	0.14	0.13	0.13	0.13	0.13
v3	0.33	4.00	1.00	4.00	0.25	0.33	0.25	0.25	0.25	0.25
v4	0.14	1.00	0.25	1.00	0.13	0.14	0.13	0.13	0.13	0.13
v5	2.00	8.00	4.00	8.00	1.00	2.00	1.00	1.00	1.00	1.00
v6	1.00	7.00	3.00	7.00	0.50	1.00	0.50	0.50	0.50	0.50
v7	2.00	8.00	4.00	8.00	1.00	2.00	1.00	1.00	1.00	1.00
v8	2.00	8.00	4.00	8.00	1.00	2.00	1.00	1.00	1.00	1.00
v9	2.00	8.00	4.00	8.00	1.00	2.00	1.00	1.00	1.00	1.00
v10	2.00	8.00	4.00	8.00	1.00	2.00	1.00	1.00	1.00	1.00

Geometric mean	**Criterion weight**	**I max**	**Average**
1.164707134	0.087729319	0.89168049	10.16399642
0.208559223	0.015709321	0.160611002	10.22393
0.529611921	0.039891997	0.412360461	10.33692202
0.208559223	0.015709321	0.160611002	10.22393
2	0.150646144	1.515065129	10.05711189
1.164707134	0.087729319	0.89168049	10.16399642
2	0.150646144	1.515065129	10.05711189
2	0.150646144	1.515065129	10.05711189
2	0.150646144	1.515065129	10.05711189
2	0.150646144	1.515065129	10.05711189
13.27614463			**10.13983343**

Annex 7: Saaty matrix for partial evaluation of of Alternatives according to criterion k6, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	2.00	0.25	1.00	0.25	0.20	2.00	1.00	0.20	0.20
v2	0.50	1.00	0.20	1.00	0.25	0.20	1.00	2.00	0.20	0.20
v3	4.00	5.00	1.00	5.00	1.00	1.00	5.00	5.00	1.00	1.00
v4	1.00	1.00	0.20	1.00	0.20	0.20	1.00	2.00	0.20	0.20
v5	4.00	4.00	1.00	5.00	1.00	1.00	5.00	5.00	1.00	1.00
v6	5.00	5.00	1.00	5.00	1.00	1.00	5.00	5.00	1.00	1.00
v7	0.50	1.00	0.20	1.00	0.20	0.20	1.00	1.00	0.20	0.20
v8	1.00	0.50	0.20	0.50	0.20	0.20	1.00	1.00	0.20	0.20
v9	5.00	5.00	1.00	5.00	1.00	1.00	5.00	5.00	1.00	1.00
v10	5.00	5.00	1.00	5.00	1.00	1.00	5.00	5.00	1.00	1.00

Geometric mean	**Criterion weight**	**I max**	**Average**
0.537159177	0.040346166	0.418955433	10.38402104
0.457305052	0.034348302	0.354122972	10.30976661
2.186724148	0.16424542	1.644768463	10.01409026
0.479311664	0.036001224	0.366265006	10.17368208
2.1384692	0.160620978	1.610420161	10.02621312
2.236067977	0.167951648	1.685114629	10.0333319
0.417265039	0.031340886	0.316849843	10.10979223
0.389322047	0.02924208	0.301848163	10.32239017
2.236067977	0.167951648	1.685114629	10.0333319
2.236067977	0.167951648	1.685114629	10.0333319
13.31376026			**10.14399512**

Annex 8: Saaty matrix for partial evaluation of of Alternatives according to criterion k7, geometric mean and I max results.

	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10
v1	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v2	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v3	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v4	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v5	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v6	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00
v7	8.00	8.00	8.00	8.00	8.00	8.00	1.00	3.00	3.00	8.00
v8	5.00	5.00	5.00	5.00	5.00	5.00	0.33	1.00	1.00	5.00
v9	5.00	5.00	5.00	5.00	5.00	5.00	0.33	1.00	1.00	5.00
v10	1.00	1.00	1.00	1.00	1.00	1.00	0.13	0.20	0.20	1.00

Geometric mean	**Criterion weight**	**I max**	**Average**
0.588704019	0.039273482	0.393210608	10.01211482
0.588704019	0.039273482	0.393210608	10.01211482
0.588704019	0.039273482	0.393210608	10.01211482
0.588704019	0.039273482	0.393210608	10.01211482
0.588704019	0.039273482	0.393210608	10.01211482
0.588704019	0.039273482	0.393210608	10.01211482
5.34056545	0.356278525	3.662014809	10.27851681
2.764183547	0.184403552	1.862138471	10.09817031
2.764183547	0.184403552	1.862138471	10.09817031
0.588704019	0.039273482	0.393210608	10.01211482
14.98986067			**10.05596612**